

To: Thomas, Kent[thomas.kent@epa.gov]
Cc: Armann, Steve[Armann.Steve@epa.gov]; Huetteman, Tom[Huetteman.Tom@epa.gov]
From: Beach, John
Sent: Wed 6/25/2014 9:11:27 PM
Subject: RE: Emissions rates from caulk

Thanks, Kent. And thanks for the phone call this afternoon. We seem to be on the same page with this stuff and it will be good for the 4 of us to talk on Friday.

John Beach
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-----Original Message-----

From: Thomas, Kent
Sent: Wednesday, June 25, 2014 11:38 AM
To: Beach, John
Cc: Armann, Steve; Huetteman, Tom
Subject: RE: Emissions rates from caulk

Hi John -

First, I am copying below a message I sent to Tom and Steve a little while ago on the emissions topic - I didn't check to see whether you were cc'd on that. In response to your message:

Thanks for sharing your normalized emission factor you derived from the NRMRL report. I agree it is not too far off what you calculated from our NERL report results.

At risk of getting into the technical weeds here, I can explain at least one reason the estimates from the NERL report Table 4-7 are lower than estimates derived from the NRMRL report. After using NRMRL's normalized emission factor equation to calculate individual congener emission rates assuming an un-weathered Aroclor 1254 in the caulk, which were then summed to get a total emission rate, we multiplied the total emission rate by a factor of 0.45. The reasons for this are explained on page 13 (see Step 7) in our report.

Of course the emissions factor will likely be different for different Aroclors, and/or Aroclors that have "weathered" differently over the years.

Let me know if more information would be helpful.

Kent

Hi Tom and Steve:

1) Our 2012 report includes emission rate estimates for both relatively high concentration caulks (>50,000 ppm) and relatively low concentration caulks (<100 ppm) found at several locations in school buildings.

Table 4-7 (p 36) - for several caulks with >50,000 ppm total PCBs, estimated emission rates ranged from

53 to 3100 micrograms per hour and depended on the PCB concentration in caulk and total surface area of that caulk in the specific location.

Tables 4-14 (p 45) and 4-16 (p 48) include emission rate estimates for caulks in several rooms with total PCB concentrations ranging from 5.2 to 68 ppm. The estimated emission rates for these caulks ranged from 0.0002 to 0.37 micrograms per hour and again depended on the PCB concentration in caulk and total surface area of that caulk in the specific location.

2) In Table 4-8 (p 38) we used the estimated emission rates for caulks with >50,000 ppm total PCBs in a few rooms, and under different conditions of ventilation (and penetration for the rooms with exterior window caulk) in a screening-level estimation of the range of indoor air total PCB concentrations that might result from the emissions from caulk. We did not do this for the rooms with caulks having <100 ppm total PCBs. There are several assumptions that go into the estimation of emission rates and indoor air concentrations - these are listed in the report.

3) For your question about whether there is a linear relationship between caulk PCB concentrations and emission rates:

NRMRL scientists measured PCB congener emission rates for 13 different caulk samples in laboratory chambers under controlled conditions of temperature and ventilation and caulk surface area. They observed a relationship between the concentration of PCB congeners in caulk and their emission rates, where increasing concentrations resulted in increasing emission rates. Their report -Laboratory Study of Polychlorinated Biphenyl PCB Contamination and Mitigation in Buildings: Part 1. Emissions from Selected Primary Sources - can be accessed from this web page:
<http://www.epa.gov/pcbsincaulk/caulkresearch.htm>.

On pg 43, the NRMRL report text states:

“There is a linear correlation between the content of a congener in the caulk and its emission factor:

$$E_i = a_i x_i$$

where

E_i = emission factor for congener i ($\mu\text{g}/\text{m}^2/\text{h}$)

x_i = content of congener i in caulk sample ($\mu\text{g}/\text{g}$)

a_i = a constant specific to congener i [$(\mu\text{g}/\text{m}^2/\text{h}) / (\mu\text{g}/\text{g})$]

Also on pg. 43, Figure 4-5 shows an example of the relationship for congener #52. It is important to remember that these tests were done at a constant temperature, and that emission rates increase with increasing temperatures.

4) Do you want to discuss estimating emission rates of PCBs from caulks for other situations or scenarios? Estimating a range of indoor air concentrations that might result from those emissions? It is possible that we could do this based on measurement data or as a simulation across a range of possible conditions. If there is interest in having us do this, a request would probably need to come to and through our management.

Kent Thomas

-----Original Message-----

From: Beach, John
Sent: Wednesday, June 25, 2014 12:42 PM
To: Huetteman, Tom
Cc: Armann, Steve; Thomas, Kent
Subject: RE: Emissions rates from caulk

Tom

As I read Table 4-7 from Polychlorinated Biphenyls (PCBs) in School Buildings: Sources, Environmental Levels, and Exposures (Thomas et al, 2012) the interior caulk PCB concentrations are generally in the 10s of percent range and the emission rates are estimated using the surface (emission) area, the caulk concentration and an empirically-derived factor relating those variables.

I derived a factor relating the emission area and caulk concentration from what I believe is the same source Kent used (Laboratory Study of Polychlorinated Biphenyl (PCB) Contamination and Mitigation in Buildings Part 1. Emissions from Selected Primary Sources, Guo 2011) based on reported emission rates and caulk concentrations from Table 4.10. The value of that factor inferred from Kent's Table 4-7 is 0.027 (ug/m2-hr)/(mg/kg) (emission rate per ppm in caulk) and mine is 0.046 (ug/m2-hr)/(mg/kg), which I consider remarkably close to Kent's.

John

-----Original Message-----

From: Huetteman, Tom
Sent: Tuesday, June 24, 2014 4:00 PM
To: Thomas, Kent
Cc: Armann, Steve; Beach, John
Subject: Emissions rates from caulk

Kent,

I was taking another look at your caulk study. Table 4-7 has various data on caulk. Do I have the correct understanding that your emission rates are all based on some of the highest caulk concentrations? I noticed that most interior caulk samples were generally below 100. Also, is there likely a linear relationship between caulk concentration and emission rates?

Thanks, Tom

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